

September 2004 NC Weather Review

Overview

September is often known as the most active month during the Atlantic hurricane season. After four tropical systems impacted North Carolina in August, many North Carolinians kept a weary eye on the tropics. By the end of September, 3 additional tropical systems (the remnants of Hurricanes Frances, Ivan, and Jeanne) impacted the state, bringing the season total to a remarkable seven. Flooding rains, damaging winds, tornadoes, and extended periods of cloudy and muggy weather became a recurring theme throughout September, which hopefully brought the unforgettable 2004 Hurricane Season to an end for residents along the Atlantic Ocean and Gulf Coast.

Precipitation

The track of the tropical systems and their remnants frequently brought the heaviest rain across western sections of North Carolina, particularly across the North Carolina Mountains. Monthly rainfall totals exceeded 10 inches across much of the western third of the state, with as much as 27 inches of rain observed at Mount Mitchell and Lake Toxaway. The northeast portion of the state, which was typically removed from the storm tracks, recorded substantially less rainfall, averaging from 3 to 5 inches. Figure 1 depicts the observed and normal rainfall for selected locations across North Carolina during September 2004. Note the excessive rainfall recorded throughout western North Carolina, with lesser amounts across eastern portions of the state.

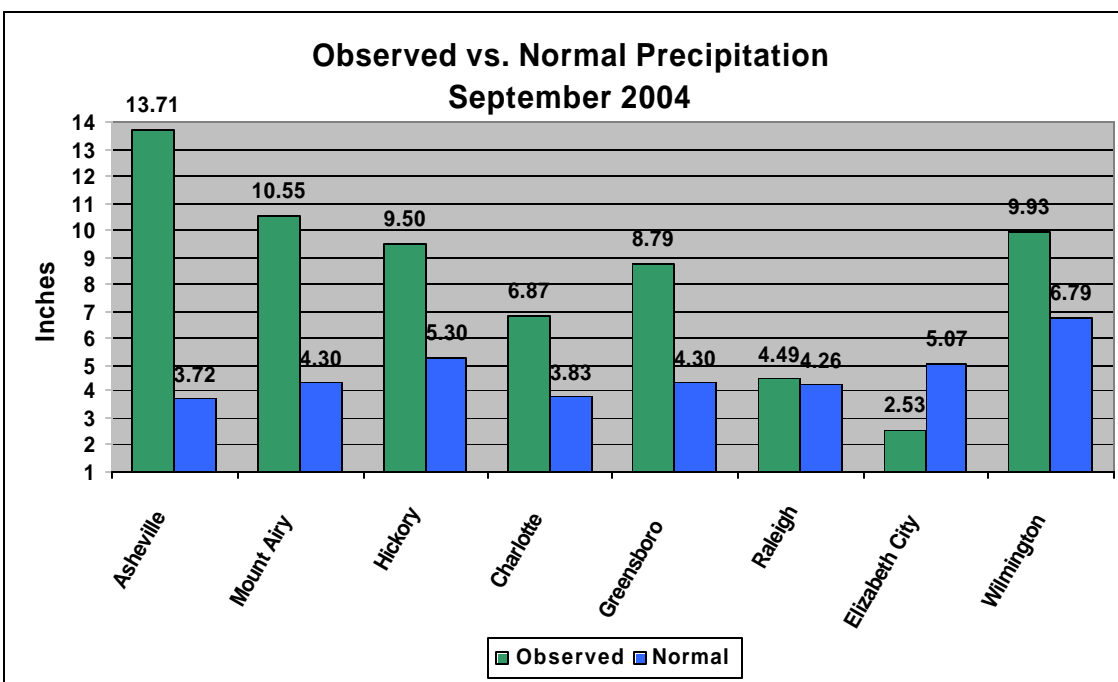


Figure 1 Monthly precipitation totals and normal precipitation totals for September 2004 at selected locations across North Carolina.

Details

The wettest conditions in September were found over the elevated terrain of western North Carolina. This region often received the bulk of the heavy rain associated with the tropical systems that impacted the state during September. Almost all of the rainfall observed in September was related in some way, to the three tropical systems that affected the state. Rainfall totals over much of western North Carolina ranged between 10 and 25 inches, which was approximately 200 to 500 percent of normal. Mount Mitchell (Yancey County), and Lake Toxaway (Rutherford County), topped all stations, with over 27 inches of rainfall recorded. Excessive rainfall of this magnitude produced numerous flash floods, several mud slides, and serious river flooding. Asheville, (typically drier than the surrounding mountains due to their location in the French Broad River Valley), shattered their September rainfall record with 13.71 inches of rain. The previous record was 9.12 inches which was set in 1977.

Several additional mountain stations recorded rainfall amounts in excess of 20 inches including: Candler (Buncombe County), 20.70 inches; Tryon (Polk County), 22.30 inches; Beech Mountain (Avery County), 20.10 inches; Brevard (Transylvania County), 20.50 inches; and Old Fort (Buncombe County), 20.11 inches. Numerous stations recorded totals in excess of 15 inches including: Morganton (Burke County), 17.12 inches; Lake Lure (Rutherford County), 17.94 inches; and Jefferson (Ashe County), 16.22 inches. The majority of reporting stations recorded amounts between 7 and 14 inches. A few of which included: Cullowhee (Haywood County), 11.94 inches; Forest City (Rutherford County), 13.04 inches; Lenoir (Caldwell County), 10.62 inches; Dobson (Surry County), 10.55 inches; and Danbury (Stokes County), 9.90 inches.

Monthly rainfall totals over the Piedmont and Sandhills generally averaged between 5 and 10 inches, with isolated amounts near 12 inches. Some rainfall reports across the Piedmont and Sandhills include: Concord (Cabarrus County), 13.9 inches; Winston-Salem (Forsyth County), 9.30 inches; Cary (Wake County), 10.5 inches; Monroe (Union County), 13.3 inches; and Shelby (Cleveland County), 11.52 inches. Rainfall amounts generally decreased toward the east and northeast across the northeast Piedmont, Coastal Plain, and northern Coastal Region. The rainfall totals were the smallest across northeastern sections of North Carolina which were far removed from the track of the tropical systems. Elizabeth City (Perquimans County) totaled only 2.53 inches for the month while North Raleigh (Wake County) totaled 3.2 inches. Cape Hatteras (Dare County) reported 4.47 inches and was the only official reporting station to report below normal rainfall for September.

A second rainfall maximum was noted over southeastern North Carolina and the southern Coastal Region. Precipitation totals for September ranged between 6 and 10 inches in these locations with Wilmington (New Hanover County) reporting 9.93 inches and New Bern (Craven County) reporting 9.49 inches of rain. The higher rainfall totals in these locations can be attributed to an onshore flow of moist air and persistent surface boundaries which were likely enhanced by the numerous tropical systems that impacted the state.

Figure 2 on the following page depicts the estimated rainfall totals for North Carolina for September 2004. The map is based on radar estimates and rainfall reports from National Weather Service Cooperative Observers and other official observing sites.

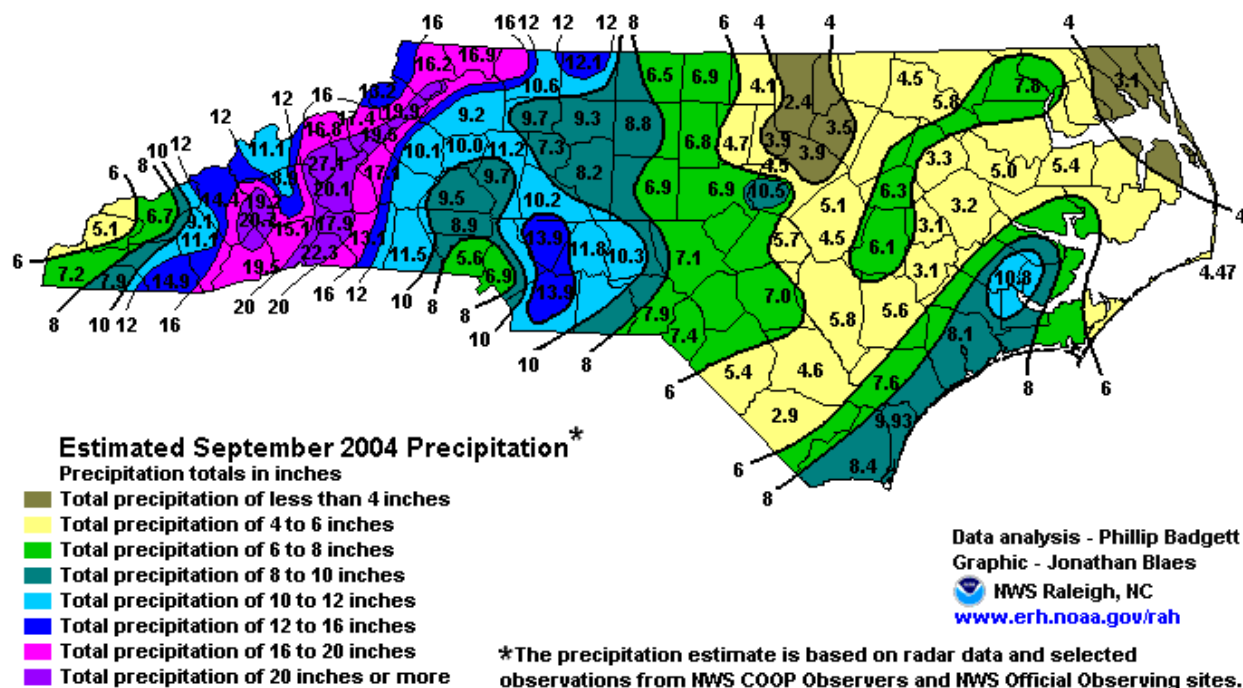


Figure 2 Estimated precipitation totals during September 2004.

Temperatures

Overall, monthly temperatures averaged very close to the 30 year normal across much of the state. Typically, "normal conditions" are lackluster, but for September, the way in which the temperatures averaged near normal was unusual. The three tropical systems that affected the state produced numerous cloudy days with unsettled weather which greatly affected temperatures. East of the mountains daily highs averaged as much as 2 to 3 degrees below normal, largely because of the clouds and rain. Conversely, the nightly lows were frequently warmer than normal due to the increased clouds and high relative humidity levels. When averaged out, the September 2004 temperatures ended up near normal.

Western and central sections of the state averaged less than a degree above normal, while the eastern sections averaged 0.1 to 0.5 degrees below normal. No observing locations reached 90 degrees during the entire month of September. Figures 3 and 4 shown on the following page highlight the daily maximum and minimum temperatures during September at Raleigh-Durham (RDU) and Greensboro (GSO). These graphs illustrate the mild daily temperature pattern experienced during the month. In addition, a common theme during the month, were warmer than normal nighttime lows, along with cooler than normal daytime highs during the passages of the tropical systems (Frances on the 6th through 9th of September), (Ivan 15th -17th), and (Jeanne 27th -29th).

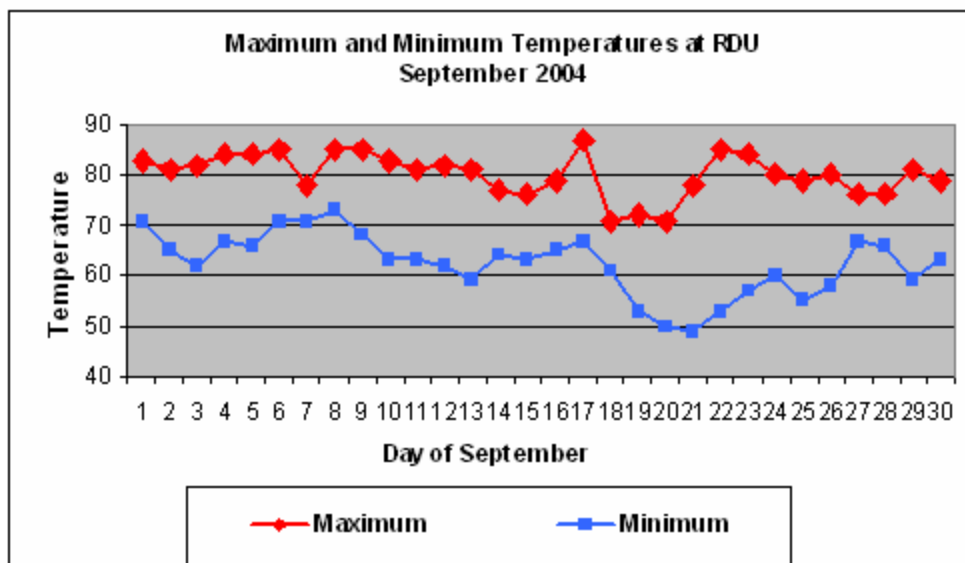


Figure 3 Daily maximum and minimum temperatures observed during September 2004 at Raleigh-Durham (RDU).

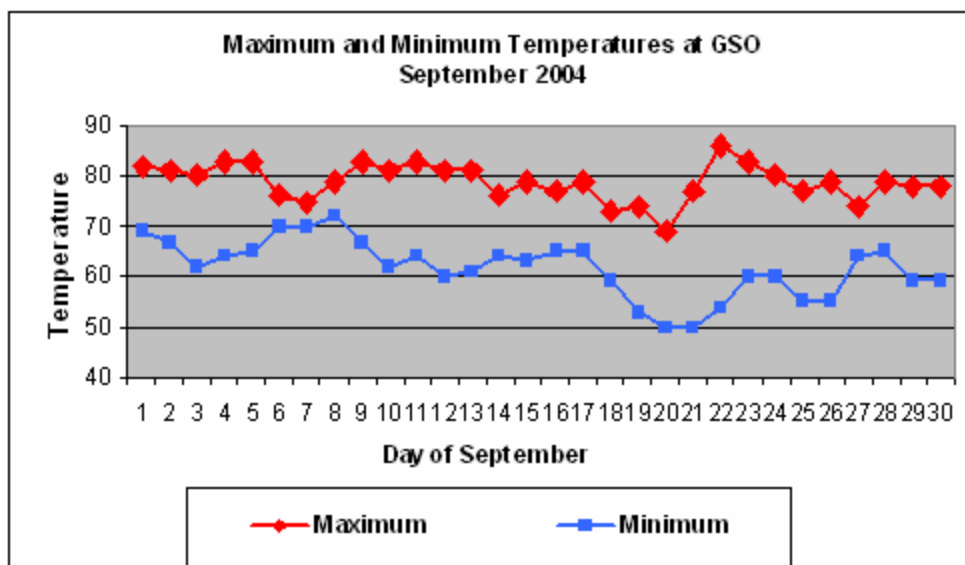


Figure 4 Daily maximum and minimum temperatures observed during September 2004 at Greensboro (GSO).

While much of the state generally had warmer than normal nights and cooler than normal days, mountain locations had the warmest nights, and the eastern areas of the state that had the coolest days.

Asheville and Mount Airy, which were representative of the mountains, experienced night time low temperatures that averaged 2.0 to 2.5 degrees above normal. Yet overall the monthly temperatures averaged only slightly above normal (Asheville 0.7 and Mount Airy 0.6 degrees above normal). To the east, Elizabeth City and Wilmington experienced daytime high temperatures that averaged between 1.5 and 2.5 degrees below normal. Yet, overall the monthly temperatures averaged slightly below normal (Elizabeth City 0.2 degrees, and Wilmington 0.5 degrees below normal)

Tropical Systems to affect the state during September

The remnants of the three September hurricanes impacted North Carolina during the month of September. Despite dissimilar tracks during their lifetimes, these systems generally took similar tracks across the Southeast U.S. After striking Florida or Alabama, all three systems turned toward the north and northeast toward western North Carolina. These storms were steered by an upper level pattern that featured a ridge of high pressure across the Carolina or Southeast coast. The tropical systems were steered around the periphery of the high pressure ridge which effectively blocked the North Carolina coast from receiving a direct strike from these storms.

Figure 5 is a map of the tracks of Hurricanes Frances, Ivan, and Jeanne.

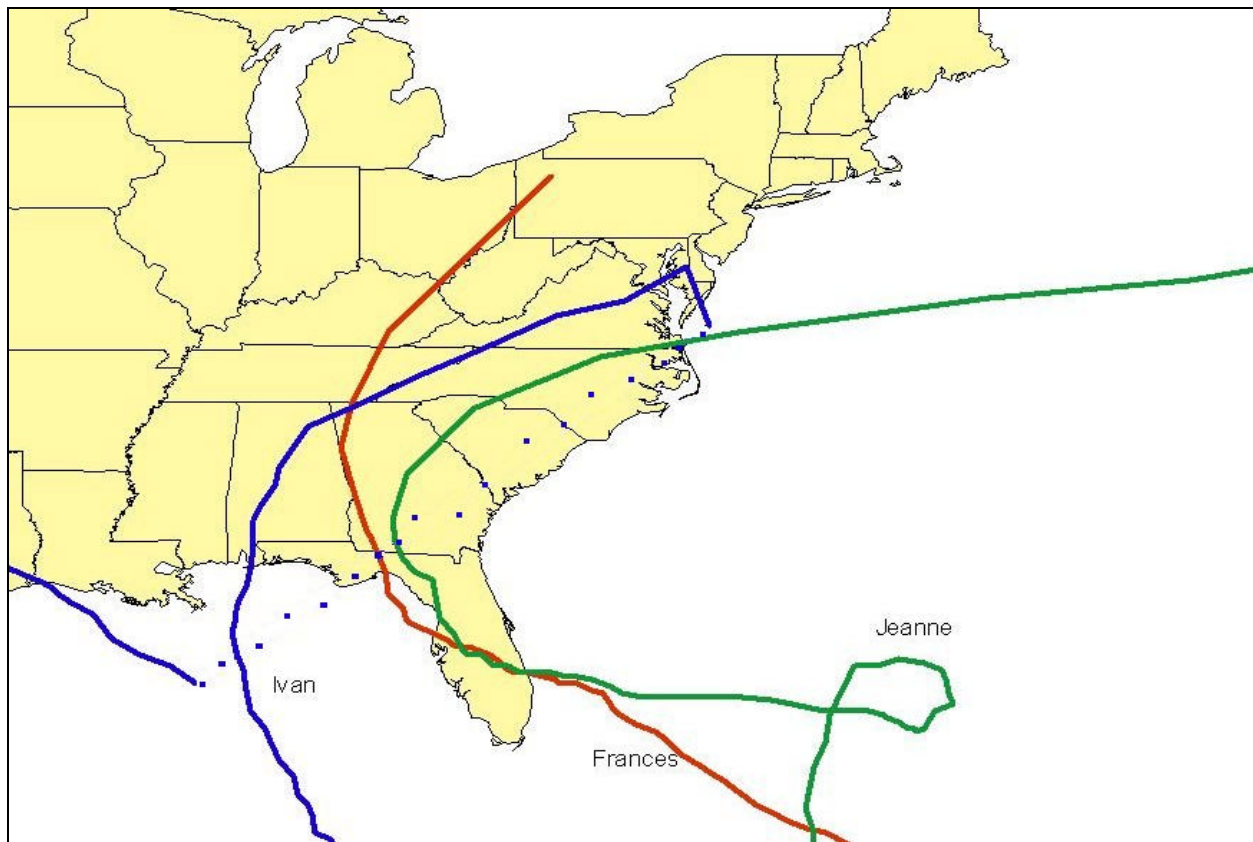


Figure 5 Final storm track of each tropical system to affect the United States during September 2004 (Frances, Ivan, and Jeanne).

Figure 6, shown on the following page, is an analyzed upper air chart from Monday night, September 14, 2004, as Hurricane Ivan was entering the Gulf of Mexico from the Caribbean. Note the ridge of high pressure located along the North Carolina coast. This upper air pattern was typical of the pattern that developed ahead of the land falling hurricanes as they impacted the southeastern United States in September.

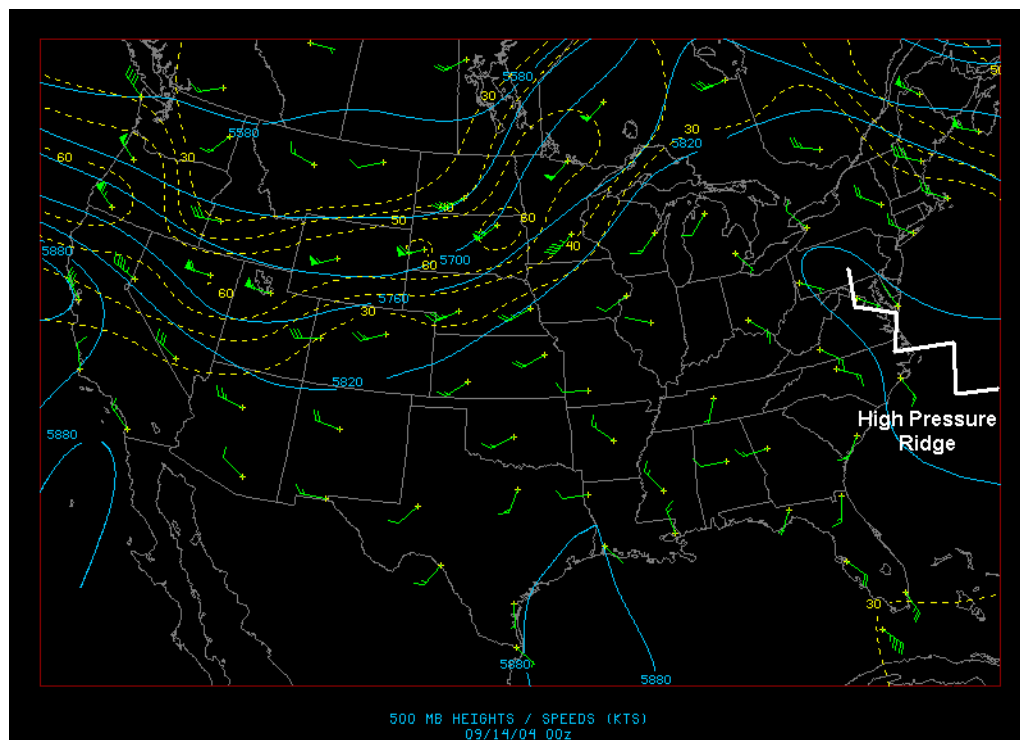


Figure 6 Analyzed upper air chart Monday night, September 14, 2004

In addition to Hurricanes Frances, Ivan, and Jeanne, there were several tropical systems that developed into hurricanes in the Atlantic basin that did not strike the United States. Figure 7, shown below, is a satellite image from September 21, 2004 that shows three named storms over the Atlantic, Hurricanes Jeanne and Karl, along with Tropical Storm Lisa. Jeanne would be the only one of the pictured storms to strike the United States.

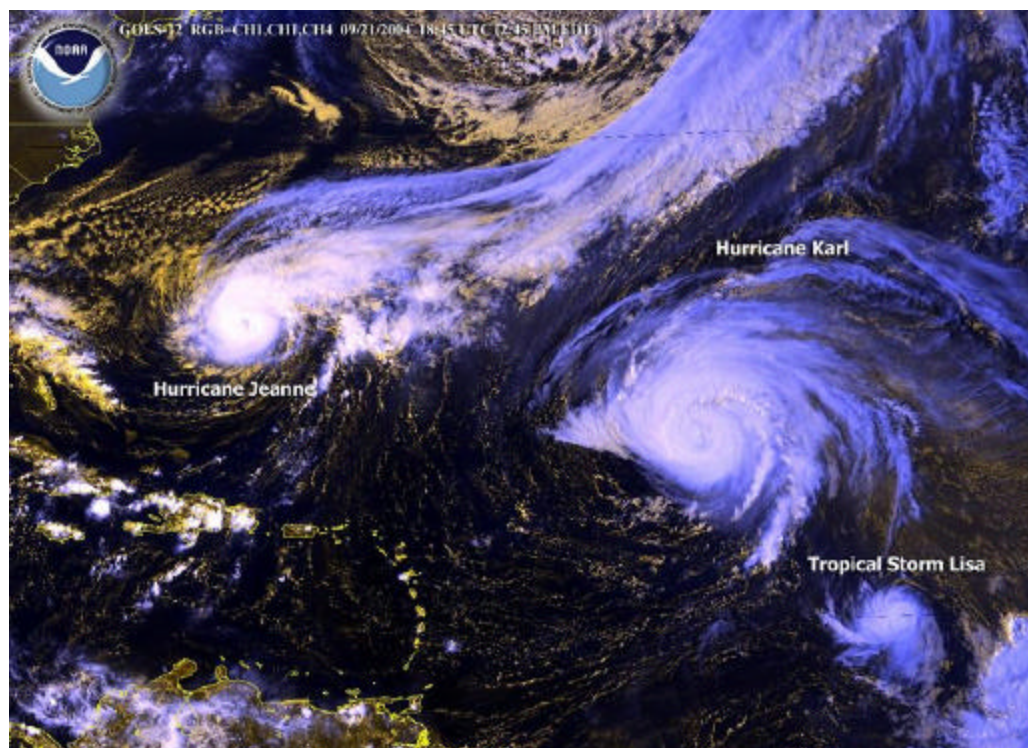


Figure 7 Hurricanes Jeanne and Karl and Tropical Storm Lisa are shown over the western Atlantic at 245 PM EDT on September 21, 2004

Additional information on Hurricanes Frances, Ivan, and Jeanne can be found at the NWS Raleigh website at ...

<http://www.erh.noaa.gov/rah/events/>

Current, Semi-Annual and Annual Precipitation Trends

Rainfall in September had a significant impact on current rainfall trends across North Carolina. The 4.49 inches of rain recorded at Raleigh during September boosted the summer (June through September) rainfall total to 26.13 inches, which is 10.38 inches above normal.

Raleigh-Durham began the first five months of 2004 with below normal precipitation, while the most recent four months have produced above normal precipitation. As of October 1, 2004, Raleigh-Durham has a 2004 rainfall surplus of 5.30 inches. The 12 month (October 2003 through September 2004) precipitation total has a surplus of 9.97 inches.

Greensboro, which was not significantly affected by the rainfall associated with tropical systems in August, was hit hard with 8.79 inches of rain in September. The 8.79 inches was 4.30 inches above the monthly normal. September became only the second month in 2004 in which Greensboro recorded above normal precipitation.

As of October 1, total precipitation for the year totaled 29.83 inches, which is 4.21 inches below normal. Conversely, during the past 12 months (October 2003 through September 2004), Greensboro has a surplus of 4.81 inches. Semi-annual and annual precipitation trends at Raleigh-Durham and Greensboro are shown in Figures 8 and 9 respectively.

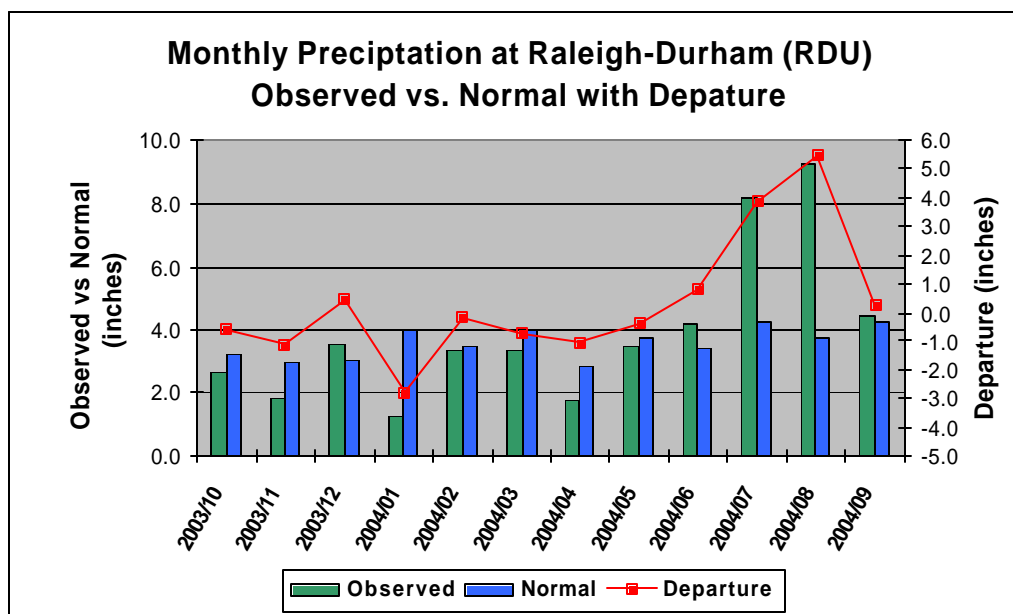


Figure 8 Semi-annual and Annual Precipitation Trends at Raleigh-Durham (RDU).

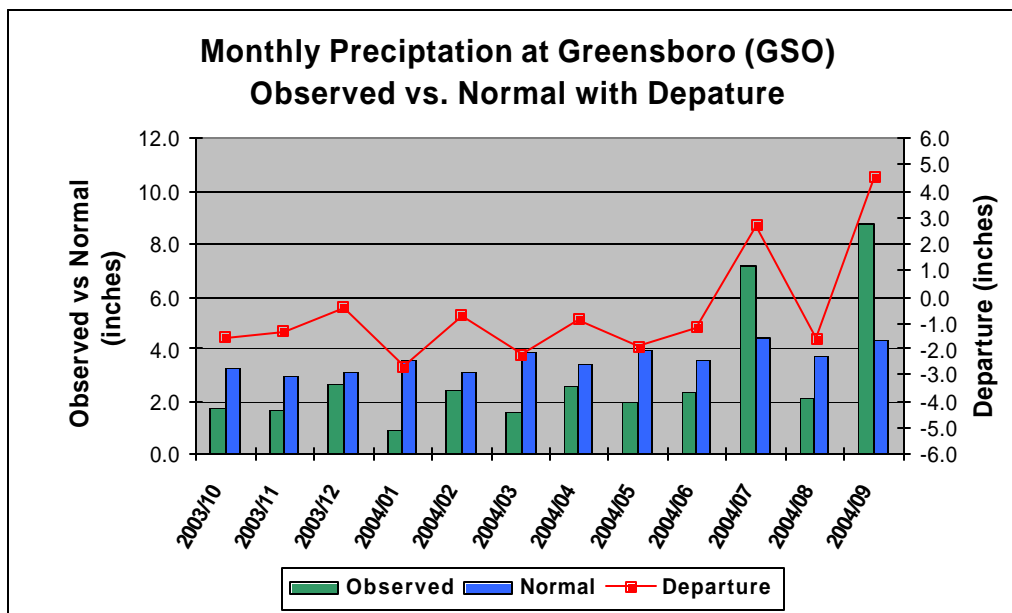


Figure 9 Semi-annual and Annual Precipitation Trends at Greensboro (GSO).

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